

A new species of *Placusa* Erichson (Coleoptera, Staphylinidae, Aleocharinae) from China

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Abstract

A new species, *Placusa pinearum* Gao, Ji, Liu, sp. nov. from China, is described and illustrated. The line drawings of aedeagus, spermatheca and scanning electron micrographs of different parts of mouthparts and body are provided.

Key words: Staphylinidae, Aleocharinae, *Placusa pinearum*, new species, China

Introduction

The genus *Placusa* was originally reported by Erichson in 1837. It was characterized by 4-4-5 tarsal formula and subcortical habitat, and was classified under tribe Placusini (including *Placusa* Erichson and *Euvira* Sharp) based on the unique morphological characters of mouthpart structures (Ashe 1991). Klimaszewski (2007) argued that there are fundamentally different genital features between the two genera, and therefore the genus *Euvira* should be excluded from the tribe Placusini. The diagnostics of species from the subfamily Aleocharinae is based mainly on the shape of the aedeagus (Gusarov 2003).

Klimaszewski (2001) mentioned that *Placusa* embraces about 50 species worldwide. Alfred Newton provided us with a worldwide checklist of the genus *Placusa* with 143 species (the checklist will be placed on <http://field-museum.org/> in the near future), including 9 species distributed in China (Appendix 1). Of the 9 Chinese species, Pace (1998, 1999, 2010) recorded 5 species: *P. kadooriorum*, *P. montium*, *P. sculpticollis*, *P. shimanensis*, *P. yunnanicola*. Mannerheim (1830) recorded 1 species: *P. atrata*; Mäklin (1945) recorded *P. depressa*; Bernhauer (1934) recorded *P. longipennis*; and Waltl (1838) recorded *P. tachyporoides*. The majority of the described species of *Placusa* occur in Holarctic, Oriental, Neotropical, and Australian regions (Klimaszewski 2001).

In our investigation (2008–2010) of the arthropods fauna of pine shoot tunnel bored by *Dioryctria rubella* Hampson (pine tip moth), we found a new species of *Placusa* based on a morphological comparison with the recorded species. This paper presents the key morphological characters of this new species, including the line drawings of aedeagus and spermatheca, and scanning electron micrographs of the different parts of mouthparts and body.

Material and methods

41 adult specimens (Appendix 2) were examined. The specimens were cleaned in distilled water for 1–2 h, then transferred to cold 10% potassium hydroxide and kept for about 48 h, and dried in the air for 1–2 h. Dissection of male and female genitalia was performed by using the techniques described by Hanley (2003). All specimens examined were mounted in glycerin. Photographs were taken with a stereoscopic microscope Leica MZ 16. The images were captured with computer software DT300 (Image Manager), and the final versions of line drawings and photographs were prepared with Adobe Photoshop software, version 7.0.

For the scanning electron microscopic photographs, the specimens were cleaned with distilled water in ultrasonic cleaner for 1–2 h, fixed in 2.5% glutar-aldehyde for 24h, cleaned with phosphate buffer solution, fixed in 1% osmium tetroxide for 1h, cleaned with phosphate buffer solution again, and transferred to ethanol for dehydration. After being dehydrated, the specimens were dried at the critical point (HITACHI HCP-2) and coated with gold (HITACHI E1010). Photographs were taken with a scanning electron microscope (QUANTA 200).

The terminology used mainly follows Ashe (1994) and Klimaszewski (2001). The following abbreviations are used in the text: HW = head width; HL = head length; HW/HL = head width by head length; PW= pronotum width; PL= pronotum length; PW/PL = pronotum width by pronotum length; EW= elytra width; EL=elytra length; EW/EL= elytra width by elytra length (Eldredge 2010).

Genus *Placusa* Erichson, 1837

Type species: *Placusa pumilio* Erichson 1837

Diagnosis. This genus is distinguished by the following combination of characters: **1**) tarsal formula 4-4-5, metatarsus with basal segment elongate and at least as long as the two following segments combined (Ashe 1991, Klimaszewski 2001); **2**) pronotum transverse, from one-half to two-thirds broader than long, base arcuate, pubescence usually short and dense, directed approximately straight posteriad, sometimes obliquely laterad, particularly near the posterior part of the median line and the base of the disc (Klimaszewski 2001); **3**) antenna with last segment flattened, broad moderately elongate (Klimaszewski 2001); **4**) procoxal cavities open behind; mesosternum short, projecting to a maximum of half the mesocoxal length, narrowly triangular and pointed; mesocoxae in contact medially (Klimaszewski 2001); **5**) the labral chaetotaxy with the number of setae arranged in a pattern (Ashe 1991); **6**) mandible with dorsal molar area modified to transverse rows of large teeth and with defined distribution of dorsal sensory pores (Ashe 1991); **7**) maxillary palpi 4-segmented, basal segment small, apical segment narrowly elongate and about half the length of the preapical segment (Ashe 1991); **8**) labial palpi 2-segmented and very short (Ashe 1991); **9**) ligula short, broadly rounded (Ashe 1991); **10**) labium with lateral pseudopores and prementum reduced (Ashe 1991); **11**) male tergite 8 with a variable number of small to large spines-dents (Johnson 1968, Klimaszewski 2001); **12**) median lobe of aedeagus with narrowly elongate, appendage-like structure, rather loosely connected to the anterior bulbus between bases of parameres (Klimaszewski 2001); **13**) flagellum long and multiply coiled basally (*Tachyporoides* group) or short and inconspicuous (*Canadensis* group) (Klimaszewski 2001); **14**) spermatheca simple, capsule small and approximately spherical, duct sinuate and sometimes with irregular posterior coils (Klimaszewski 2001).

Placusa pinearum Gao, Ji, Liu, sp. nov.

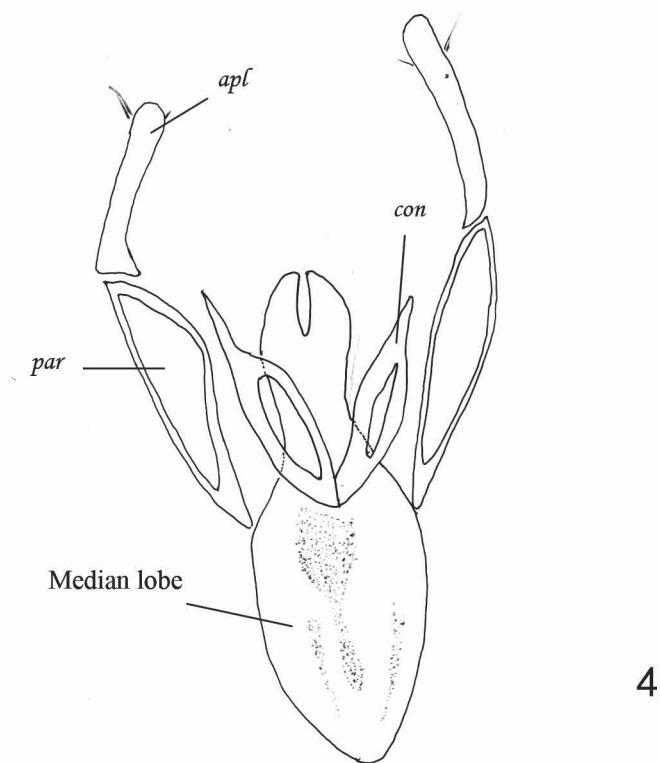
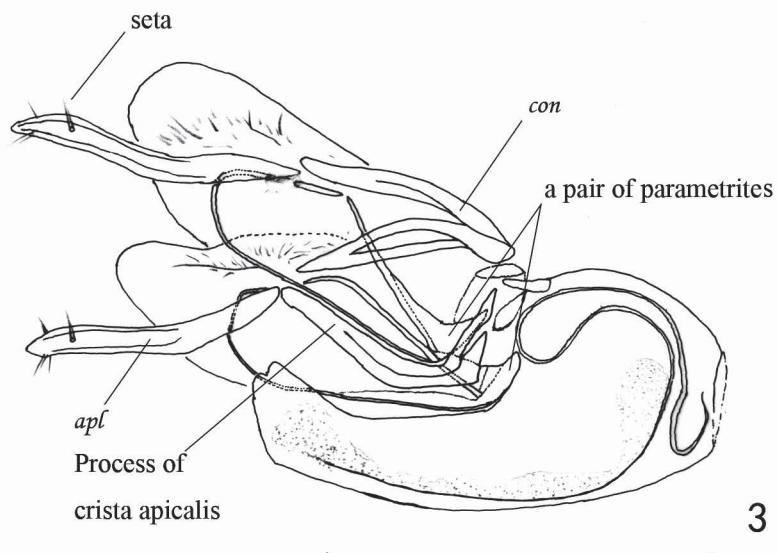


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FIGURES 1–2. *Placusa pinearum* Gao, Ji, Liu, sp. nov.: 1. adult in dorsal view; 2. the habitate. Scale bar 1 mm.



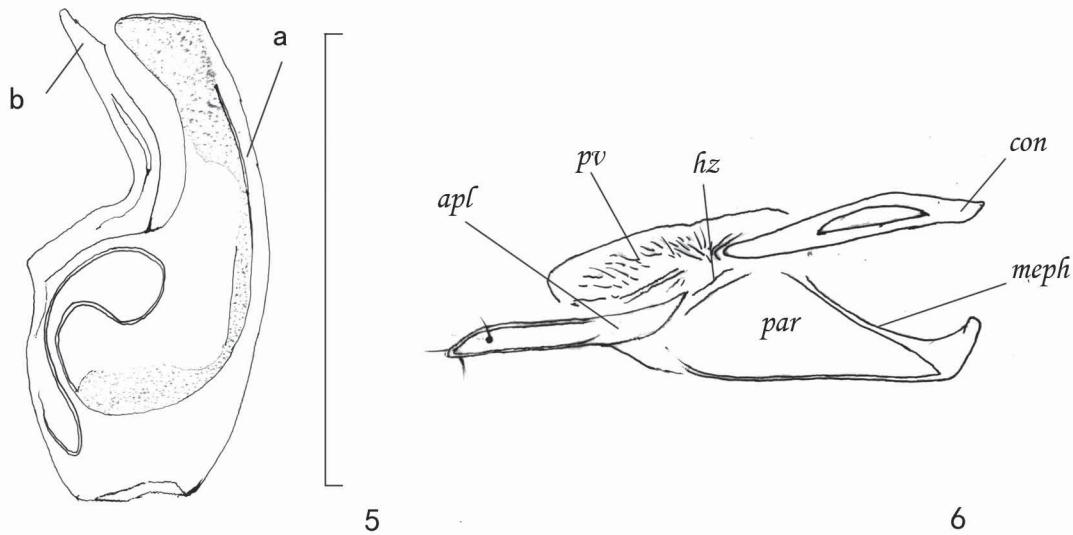
FIGURES 3–4. *Placusa pinearum* Gao, Ji, Liu, **sp. nov.**: 3. aedeagus in lateral view; 4. aedeagus in dorsal view (*apl*, apical lobe of paramerite; *con*, condylite; *par*, paramerite). Scale bar 0.25 mm.

Type material. HOLOTYPE (♂): China, Jiangsu province, Jurong, 15 May 2008, coll. B.Z. Ji & J.Y. Gao.

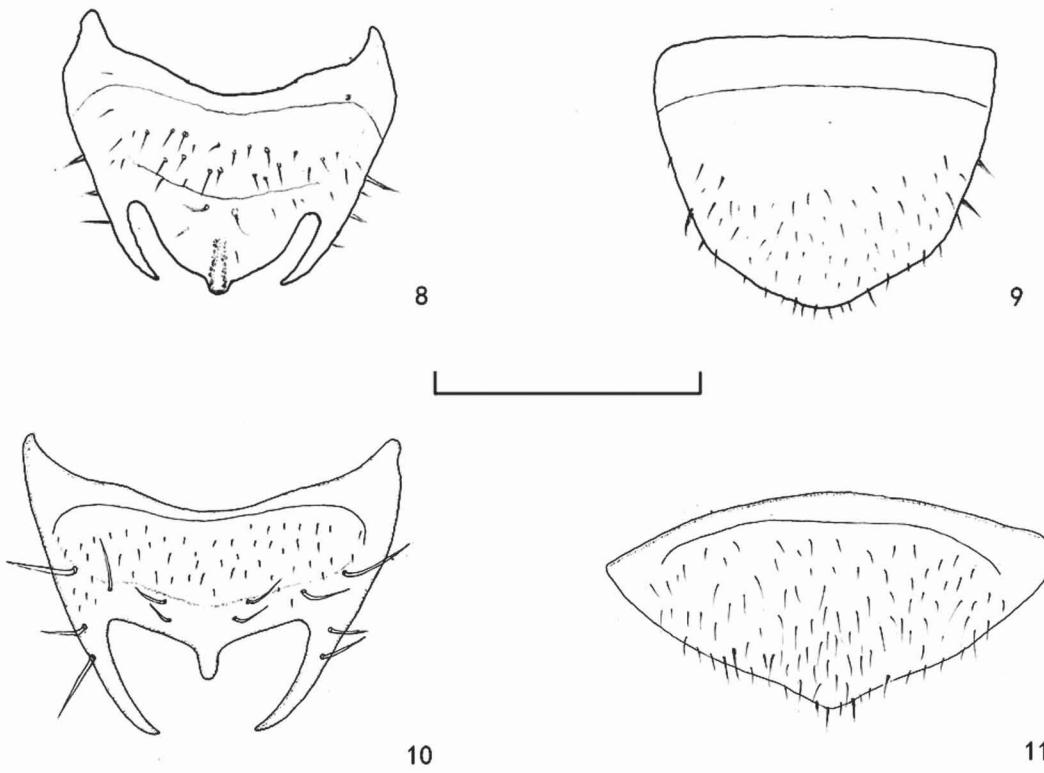
PARATYPES: 1♀, China, Anhui province, Quanjiao, 2 May 2011, coll. J.Y. Gao; 2♂, China, Jiangsu province, Lishui, 12 June 2008, coll. J.Y. Gao; 1♀, China, Jiangsu province, Lishui, 12 June 2008, coll. J.Y. Gao.

All type specimens are deposited at the Insect Museum of Nanjing Forestry University in China.

Description. **Body** Average body length 2.2 mm (n=41), bicolor with head, pronotum, abdomen dark black and elytra bronze yellow, antenna and legs light yellow (fig. 1).



FIGURES 5–6. *Placusa pinearum* Gao, Ji, Liu, sp. nov.: 5. median lobe of aedeagus in lateral view (a, flagellum; b, process of crista apicalis); 6. paramerite of aedeagus (apl, apical lobe of paramerite; con, condylite; hz, hinge zone; meph, medial phragma; par, paramerite; pv, paramerite velum). Scale bar 0.25 mm.



FIGURES 8–11. *Placusa pinearum* Gao, Ji, Liu, sp. nov.: 8. female tergite 8; 9. female sternite 8; 10. male tergite 8; 11. male sternite 8. Scale bar 0.25 mm.

Head wider than long (HW=0.31mm; HL=0.23mm; HW/HL=1.35; n=41) with an obvious neck (fig.1); eye large nearly occupying most of the visible lateral region of head, diameter of an ommatidium 7um, ommatidia with sparse setae; antenna with 11 segments, 1–3 elongate, 4–10 transverse, moniliform, usually less than twice as wide as long, and the last segment somewhat clavate (fig. 14).

Mouthparts Labrum transverse, with 18 setae symmetrically arranged on the two sides of longitudinal midline of labrum (fig. 17); the molar region of the dorsal surface of the mandibles with 6 rows of large teeth-like denticles (fig. 12); two-segmented labial palpi with sparse setae; ligula large broadly rounded and with small sensory pores on its surface (fig. 18); maxillary palpi with 4-segmented (fig. 13), apical segment with a few sensory pores.

Pronotum wider than long (PW=0.39mm; PL=0.26mm; PW/PL=1.5; n=41), slightly concave longitudinally; microsetae directed approximately straight posteriad on both sides of the median line of the disc, and 2–3 rows of microsetae directed obliquely laterad near the base of the disc; and posterior margin of pronotum sinuate (fig. 15).

Elytra wider than long (EW=0.48mm; EL=0.35mm; EW/EL=1.37; n=41), and longer than pronotum (EL/PL=1.35); posterior margin straight; hind wings developed.

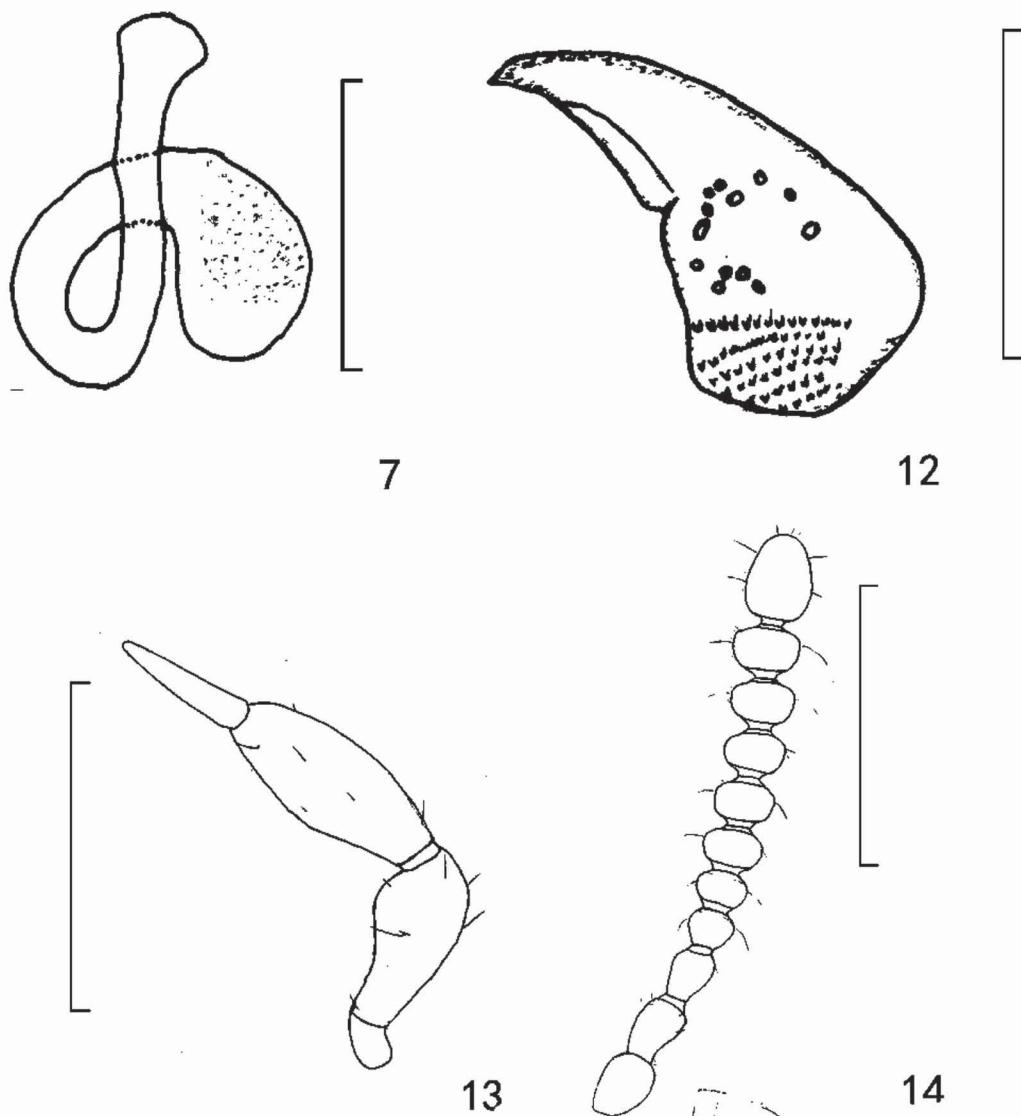
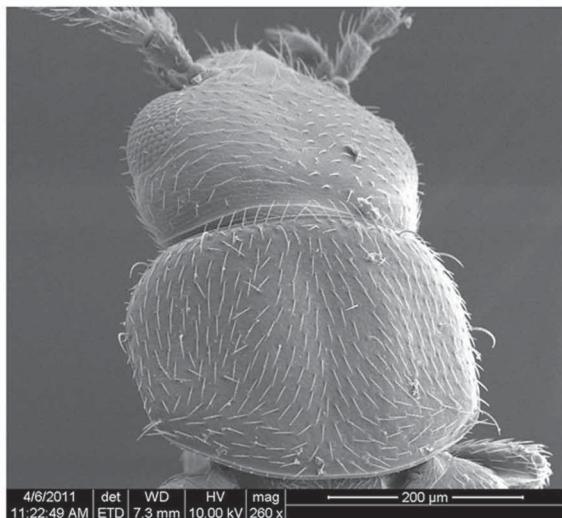
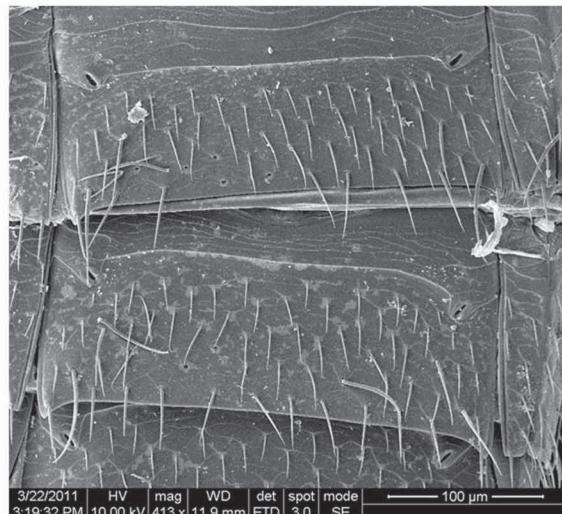


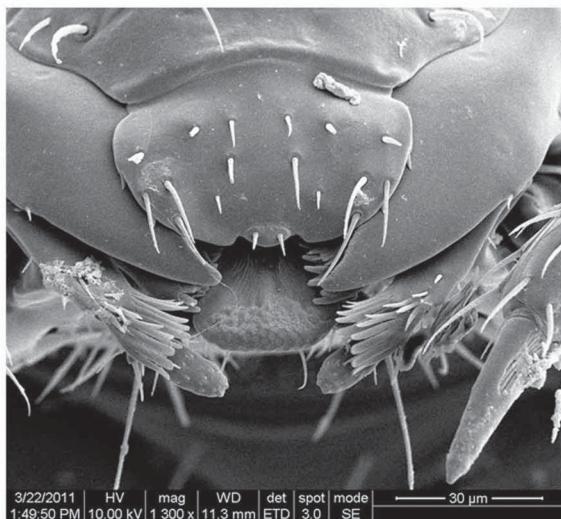
FIGURE 7, 12–14. *Placusa pinearum* Gao, Ji, Liu, sp. nov.: 7. spermatheca in lateral view, scale bar 0.1 mm; 12. mandible in dorsal view, scale bar 0.1 mm; 13. maxillary palpi, scale bar 0.1 mm; 14. antenna. Scale bar 0.5 mm.



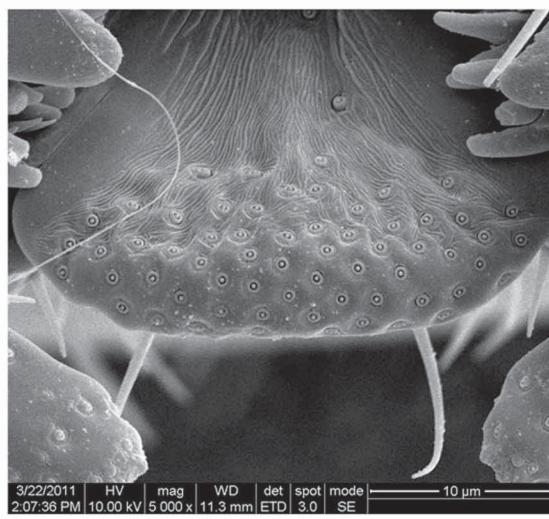
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FIGURES 15–18. *Placusa pinearum* Gao, Ji, Liu, sp. nov.: **15.** pronotum and head; **16.** the pattern of setae distribution on abdominal segments 5–6; **17.** labral chaetotaxy; **18.** ligula.

Abdomen with clear transverse lines, located between pair of spiracles, on two-thirds of abdominal segments; uniformly covered with dense setae below the transverse line of every tergite, without setae in front of the transverse line of every tergite (fig. 16); and brush-shaped edge on the posterior margin of tergite 7.

Male tergite 8 narrowly produced medially and with two lateral teeth (fig. 10); sternite 8 broad and pointed medially (fig. 11); median lobe of aedeagus with enlarged bulbus, tubus slightly curved, apex truncated in lateral view; flagellum long, and coiled about 2 times (fig. 3, 5); ventral process of crista apicalis narrow and pointed apically (fig. 5); paramere as illustrated with 4 macroseata on apical lobe (figs. 3, 4, 6).

Female tergite 8 with one broad median projection and two lateral teeth (fig. 8), sternite 8 broadly rounded apically (fig. 9); spermatheca with small and spherical capsule, and twisted in median portion (fig. 7).

Diagnosis. *Placusa pinearum* may be distinguished by the following combination of characters: male and female tergite 8 with one long median projection and two elongate lateral teeth; flagellum coiled and different in form from the other recorded species; and spermatheca with small and spherical capsule, median portion of spermathecal stem twisted and φ-shaped.

Habitat and distribution. The adults of *Placusa pinearum* were found living in pine shoot tunnels bored by *D. rubella* (fig. 2). We noted that the species of pine tree in which *Placusa pinearum* occurred were usually *Pinus*

taeda Linnaeus, *P. massoniana* Lamb and *P. thunbergii* Parl, and *Placusa pinearum* especially preferred to occur in *P. taeda* and *P. massoniana* (5 to 8 years old).

In China, there are 9 species of *Placusa* reported from Heilongjiang, Sichuan, Gansu, Yunnan, Guangdong and Hong Kong, but in our study, *Placusa pinearum* was found in 8 different locations in Jiangsu, Anhui, Hunan, Yunnan (Appendix 2).

Etymology. The specific name is derived from the unique habitat, where the type species was collected.

Discussion

In our study, we found that there was a certain relationship between the diameter of pine shoot and the probability of occurrence of *Placusa pinearum*, and the larger the diameter of pine shoot (usually more than 1.5 centimeters) was, the more likely this beetle was present. *Placusa pinearum* preferred fresh pine shoot tunnels than the older ones. Furthermore, *Placusa pinearum* was found living in groups (usually 3–5 adults or larvae living together) in one pine shoot tunnel.

The larvae of *Placusa pinearum* usually occurred from May to August. In contrast, the adults could be found at any time of the whole year based on the 3-year investigation, which indicates that *Placusa pinearum* may overwinter at the adult stage. The larvae of *Placusa pinearum* were also found living in pine shoot tunnels bored by *D. rubella*. In addition, we also found an interesting phenomenon that there was a high degree of niche overlap (co-occurrence) between *D. rubella* and *Placusa pinearum* (Gao 2010), and it is probable that *D. rubella* may be controlled by this beetle as a vector insect.

In another study, the 18S rRNA and mitochondria COI of the specimens from different locations in China have been sequenced. The results of the sequence data analysis showed that there was a certain genetic differentiation among the specimens of *Placusa pinearum* from the different geographical locations in China. However, considering the morphological characters, habitat and molecular biology data, we consider that all the specimens collected in this study are treated as the same species.

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APPENDIX 1. The list of 9 recorded species of genus *Placusa* in China.

Genus	Species	Author	Reported year	Distribution
<i>Placusa</i>	<i>atrata</i>	Mannerheim	1830	China (Heilongjiang)
<i>Placusa</i>	<i>depressa</i>	Mäklin	1845	China (Heilongjiang)
<i>Placusa</i>	<i>kadooriorum</i>	Pace	1999	China (Hong Kong)
<i>Placusa</i>	<i>longipennis</i>	Bernhauer	1934	China (Sichuan)
<i>Placusa</i>	<i>montium</i>	Pace	1998	China (Gansu)
<i>Placusa</i>	<i>sculpticollis</i>	Pace	1998	China (Yunnan)
<i>Placusa</i>	<i>shimianensis</i>	Pace	2010	China (Sichuan)
<i>Placusa</i>	<i>tachyporoides</i>	Waltl	1838	China
<i>Placusa</i>	<i>yunnanicola</i>	Pace	1998	China (Guangdong, Hong Kong, Yunnan)

APPENDIX 2. The sampling sites of *Placusa pinearum* Gao, Ji, Liu, **sp. nov.** in our study.

Host pine	Sampling Sites (all in China)	Examined Specimens (adults)	Collected date	Collector
<i>Pinus taeda</i>	Jiangsu Jurong N=32°07'19.79" E=119°11'51.49"	2♂4♀	5-15-2008	JI Baozhong; GAO Jiangyong
<i>Pinus taeda</i>	Jiangsu Lishui N=31°39'01.79" E=118°59'29.26"	3♂2♀	6-12-2008	JI Baozhong; GAO Jiangyong
<i>Pinus massoniana</i>	Jiangsu Gaochun N=31°22'17.12" E=119°03'39.52"	2♂6♀	8-20-2008	JI Baozhong; GAO Jiangyong
<i>Pinus massoniana</i>	Jiangsu Suzhou N=31°16'32.89" E=120°25'14.31	1♂5♀	5-5-2010	GAO Jiangyong
<i>Pinus taeda</i>	Anhui Quanjiao N=32°03'46.40" E=118°00'54.68"	3♂3♀	5-2-2011	GAO Jiangyong
<i>Pinus thunbergii</i>	Anhui Maanshan N=31°39'00.54" E=118°33'33.07"	2♂3♀	6-21-2009	GAO Jiangyong
<i>Pinus massoniana</i>	Yunnan Kunming N=25°07'04.50" E=102°41'09.29"	1♀	9-20-2009	ZHAO Jiejun
<i>Pinus massoniana</i>	Hunan Changsha N=28°24'24.96" E=113°01'48.01"	2♂2♀	8-15-2009	GAO Jiangyong; WANG Guoxing